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THE COMMONWEALTH OF MASSACHUSETTS

JULY, 1982

POSSIBLE FUNDING ARRANGEMENTS FOR PUBLIC RETIREMENT SYSTEMS

Retirement Law Commission

1 ASHBURTON PLACE, BOSTON, MASS. 02108

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MASSACHUSETTS RETIREMENT LAW COMMISSION

Possible Funding Arrangements for Public Retirement Systems of The Commonwealth of Massachusetts

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SECTION 1. INTRODUCTION

William M. Mercer, Incorporated has entered into a contract with the Massachusetts Retirement Law Commission to develop alternative funding arrangements which might be used by the public retirement systems in the Commonwealth to fund those systems on an actuarial basis.

At the present time, the public retirement systems in Massachusetts are required to fund on what is known as a pay-as-you-go method. This method requires that the governmental entity or entities whose employees are members of a retirement system must fund in each fiscal year the amount of retirement allowances, over and above the annuity payment provided from employees' contributions (Annuity Reserve), which will actually be paid to retired members and beneficiaries in that year. There is no advance funding required. Under an advance funding program, funds in excess of the retirement payments would be contributed, invested to earn income, and cause future years' contributions to be level according to a particular measurement index, such as payroll of active members.

In 1976, the Funding Advisory Committee recommended a system of actuarial funding for the public retirement systems of the Commonwealth. This system involved a phase-in over a number of years to an actuarial funding basis which provided for amortizing existing unfunded actuarial liabilities over a 40-year period.

Chapter 559 of the Acts of 1977 authorized cities, towns and districts to establish special funds for advance funding retirement systems, and to contribute to and invest such funds for the sole purpose of offsetting future funding costs required by Chapter 32. Funding under this Act is purely voluntary, and no basis for determining the annual amounts to be funded is specified, except for a limitation on the amount to be funded in any one year. Several cities and towns have established and contributed to a fund established under Chapter 559, as has the Commonwealth for its two major retirement systems (State Employees' and Teachers').

This report will analyze the consequences of continued funding on the pay-as-you-go funding method, and compare this to other alternative methods which involve advance funding schedules determined by actuarial cost methods.

SECTION 2. ADVANCE ACTUARIAL FUNDING - GENERAL

Uniqueness of Pension Plans

Among those non-cash benefits being provided to employees by their employers, pension plans and the liabilities they generate seem to have captured the greatest amount of interest and concern. The concern is expressed not only by those directly involved with a pension plan, the sponsoring entity and the beneficiaries of the plan, but by the Federal Government, the media and the public at large.

What is there about a pension plan which makes it different from most other labor costs?

First, the benefits provided by the plan are being earned while the employees are working; as a result, the cost of providing these benefits is being incurred as the employee renders his service; yet, these benefits do not actually have to be paid to the employee until many, many years later.

Thus, each city or town of the Commonwealth is incurring a labor cost today for its employees earning pension benefits, but under the pay-as-you-go funding arrangement there will be no cash expense recognized for that labor cost until many years hence. A 25-year-old employee may not start to collect the pension he earns in 1982 until 30, 35, or 40 years from now.

This unique aspect of the cost of providing pension benefits to employees tempted many employers in the private and public sector to defer recognizing

the expense and contributing the cash until the benefits actually had to be paid out to the retiring employee.

Funding Requirements Under Federal Law

In 1974, Congress passed The Employee Retirement Income Security Act (ERISA) which imposed strict funding standards upon private employers which sponsor pension plans for their employees. The majority of private employers had been funding their pension plans at or above the level required by ERISA before 1974, but many had not. Although there has been considerable activity in Congress regarding a similar requirement for state and local governmental pension plans, no such requirement exists at the present time. A large number of public retirement systems, in and outside of Massachusetts, do not advance funding at all.

Why Advance Fund?

- Under an advance funding program, costs can be reasonably well forecasted and made to remain reasonably level as related to some labor cost index, typically the annual payroll of active employees.
- By advance funding, the labor cost associated with the pension being earned by active employees is paid for at the time that cost is actually incurred. That portion of the cost (pension earned) of providing services to today's taxpayers is charged to today's taxpayers instead of being deferred and charged to future generations of taxpayers for whom those employees will never provide any services.

- The security of the benefits earned by the employees is enhanced by having funds set aside in a trust to pay them their retirement benefits after they retire.
- The system does not build up huge unfunded liabilities which point out clearly the way the obligation is being deferred to the future, and which may injure the credit rating of the governmental entity.
- The funds which are set aside in trust are invested, and the investment income earned on the trust assets offsets a good deal of the eventual cost of paying the retirement benefits. Typically, investment earnings alone provide 60% to 70% of the cost of benefits in a well-funded pension system. Actual contributions by employees and the employer provide for the cost of the other 30% to 40% of pension benefits paid.
- The true, long-term cost of proposed improvements to the benefits of the system are far more accurately measured on an advance funding basis than on the pay-as-you-go basis. A proposed improvement that would increase all future retirees' pensions by 10% would reflect a 10% increase in the cost of the program for the next year on advance funding. This same improvement on pay-as-you-go funding would only be reflected in next year's cost with respect to those who retire in the next year, most likely indicating a net increase of less than 1% to the plan whose costs must be increasing by 10% since all pensions will be 10% higher.

How Advance Funding Works

Under a retirement system, a promise is made to pay certain benefits to those who participate in the system, usually employees of the employer

who establishes and operates the system. The promised benefits are primarily retirement income, although certain benefits are often provided to survivors of members who die prematurely and to members who become disabled.

This primary purpose of paying retirement income for life to members who participate underscores the long-term nature of the pension promise. A member who joins the system at age 20 may eventually retire under it and collect retirement benefits until age 80 or 90 - a time span of 60 or 70 years.

For this reason, funding for a promised pension requires long-range forecasting of certain events, such as:

- mortality rates among members
- turnover rates among members
- age at which members will retire and collect benefits
- investment return on contributions to the fund
- rate at which members' salaries will increase
- rate at which inflation will require post-retirement adjustments to pensions.

These are called actuarial assumptions, and are used in projecting the long-term cost of the retirement system. Of that cost, members' contributions are usually fixed as a specified percentage of their salaries, with the employer paying the balance of the cost. Therefore, it is essentially the employer's cost that is being projected using the actuarial assumptions.

These actuarial assumptions will predict the time when certain benefits will be paid and the amounts of these payments. This will enable the actuary to place a specific value on all of those benefits at a particular date, usually a valuation date, by discounting with interest from the dates of expected payment to the valuation date.

An actuarial cost method allocates that total value of all benefits to time periods, usually over the working lifetime of the member, for expensing and funding for the benefits. Most actuarial cost methods assign a portion of the total value of benefits to years of members' employment before the valuation date and the balance to years of employment after the valuation date. Each individual year's portion of the total value assigned to years after the valuation date is referred to as the normal cost of the retirement program. This is what the full cost of the retirement system would be if it had always been funded according to that cost method from the time the first member was hired, had never been amended to change benefits promised, and all actuarial assumptions had been realized exactly.

Most retirement systems are not funded from the employment date of the first member. Most retirement systems are improved from time to time, with the improvement often applying to the credit given the member for service before the date of the improvement. Despite these conditions, that portion of the total value of benefits which assumes that the plan benefits always existed as they exist currently, and that the system had been funded from the employment date of the first member, is assigned to service periods prior to the valuation date.

This portion of the total value of benefits is often referred to as the accrued liability, or actuarial accrued liability, of the system. To the extent that assets accumulated from the funding and investing in prior years do not equal the accrued liability, and unfunded accrued liability is present. While the portion of the total value assigned to future (normal costs) is funded over the future working lifetime of the current membership, the unfunded accrued liability is usually funded by amortizing it over a fixed period of years that usually extends beyond the future working lifetime of the member involved.

The annual cost of funding a retirement system is composed of the normal cost plus an amortization cost for the unfunded accrued liability. After the fixed period of amortization, the total annual cost of the system is the normal cost alone.

The latest actuarial valuation of the Massachusetts Contributory Retirement Systems prepared in 1981, indicated that, for the 100 systems included in the report, full actuarial funding on the Entry Age Normal Cost Method, amortizing the unfunded accrued liability over 40 years as a level percentage of payroll would require an employer normal cost contribution of 12.9% of payroll and a contribution of amortize the unfunded accrued liability of 10.9%, for a total employer contribution of 23.8% of payroll. Employees were contributing an average of 5.4% of payroll in addition to these employer amounts. On the other hand, pay-as-you-go contributions were at approximately 15% of payroll, but were projected to increase to over 30% of payroll over the next 20 years.

The advance funding cost for the phase-in system recommended by the Funding Advisory Council reached 24.9% of payroll in fiscal 1984-85, and remained at that level for the next 35 years.

SECTION 3. ALTERNATIVE ACTUARIAL FUNDING PROGRAMS

Actuarial Cost Method

All of the alternative actuarial funding programs analyzed in this report will be based upon actuarial calculations of normal cost and unfunded accrued liability using the Entry Age Normal Cost Method. The principal variation among the programs will be the schedule for amortizing the unfunded accrued liability, which represented a major part of the total contribution requirement for actuarial funding shown in the most recent actuarial valuations of the systems.

ERISA Standard

The ERISA standard for private pension plans, if applied to the public retirement systems of Massachusetts, would require that employers contribute the full normal cost each year, and

1) Amortize the initial unfunded accrued liability over a 40-year period as a level dollar amount.
2) Amortize any subsequent increase in the unfunded accrued liability over 30 years.
3) Amortize actuarial gains or losses over 15 years.

The actuarial valuations showed the following employer annual contribution requirements, expressed as a percentage of payroll, on the ERISA standard:

	Normal Cost	Amortization	Total Cost
State Employees	12.6%	16.3%	28.9%
Teachers	9.9%	18.9%	28.8%
City of Boston	12.9%	28.8%	41.7%
Other Local Boards	15.6%	21.8%	37.4%
All Boards Combined	12.9%	20.2%	33.1%

In dollars, based upon January 1, 1979, payroll, the total cost for all boards combined was shown as $1.09 billion.

Amortization As A Percentage Of Payroll

While a number of public retirement systems including state systems, fund on a basis equivalent to the ERISA standard, the majority do not. The proponents of slower funding for public pension plans point to the perpetual nature of the sponsoring entity, and the theoretically unlimited taxing power to support pension costs, as justification for a lower funding standard than ERISA imposes. Some even claim that there is no need to amortize the unfunded accrued liabilities since the systems are not exposed to the prospect of termination as are private pension plans.

These perceived differences have led a sizable number of public pension plans to amortize the unfunded accrued liability, not as a level dollar amount, but rather as a level percentage of covered payroll for active members. The January 1, 1979, actuarial valuation of the Massachusetts systems developed funding costs on the basis of amortizing the unfunded accrued liability over 40 years as a level percentage of payroll, with total payroll expected

to increase at 4½% per year (the inflation assumption in the valuation), with the following total employer funding costs, as compared to the ERISA standard of level dollar amortization:

	% of Payroll Amortization	ERISA Standard
State Employees	21.5%	28.9%
Teachers	20.3%	28.8%
City of Boston	28.3%	41.7%
Other Local Boards	27.3%	37.4%
All Boards Combined	23.8%	33.1%

Total employer funding requirements on this basis amounted to $789 million for all boards combined.

Trend Of Unfunded Accrued Liability

In order to gain some insight as to how these two funding programs differ, it may be helpful to analyze the progression of unfunded accrued liabilities.

The ERISA funding standard immediately begins to reduce the unfunded accrued liability in absolute dollar terms. The amortization process functions in the same manner as a home mortgage; that is, the annual payments must cover both interest on the outstanding principal balance and a reduction in the principal amount. In the early years of the amortization, most of the annual payments are required for interest. To illustrate using a 30-year 7% mortgage amortized by equal annual payments at the beginning of each year:

Year	Beginning Balance	Payment	Interest	Ending Balance
1	$1,000.00	$75.31	$64.73	$989.42
2	989.42	75.31	63.99	978.10
3	978.10	75.31	63.20	965.99
.	.	.	.	.
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.	.	.	.	.
28	211.48	75.31	9.53	145.70
29	145.70	75.31	4.92	75.31
30	75.31	75.31	0.00	0.00

When the principal is amortized as a level percentage of payroll, with payroll expected to increase each year at 4½%, the unfunded accrued liability actually increases for the first 22 years, after which time it decreases until it falls below the original amount in the 34th year and is fully amortized in the 40½ year. Thus, the ultimate objective is attained over the 40-year amortization period, but by a different pattern of contribution.

Since the payroll is assumed to increase at the rate of inflation (4½% in this case), the unfunded accrued liability may still be decreasing under this latter schedule in terms of real dollars, adjusting for the assumed inflation rate. This can be measured by computing the ratio of the unfunded accrued liability to the projected payroll at various points during the amortization process under each of the two methods.

The chart on page 15 shows the remaining unfunded accrued liability at various points over the 40-year period in absolute dollars and as a

multiple of the projected payroll. The initial unfunded liability and payroll figures are developed in the January 1, 1979, actuarial valuations for all boards combined, as follows:

Unfunded accrued liability	$9,126,510,000
Payroll	3,307,519,000
Ratio of liability to payroll	2.76

The chart indicates that, under the level percentage of payroll amortization method, even though the unfunded accrued liability increases in dollar amount for the first 22 years, it decreases as a percentage of payroll, or in terms of inflation-adjusted dollars. Thus, steady progress is being made in amortizing the unfunded accrued liability measured in terms of inflation-adjusted dollars under this amortization method.

Chart 1. Amortization Comparison

End of Year	Level Dollar Amortization		% of Payroll Amortization	
	Unfunded Amount*	Multiple of Payroll	Unfunded Amount*	Multiple of Payroll
1	$9,080,794	2.63	$9,392,295	2.72
2	9,031,878	2.50	9,659,897	2.68
3	8,979,538	2.38	9,928,688	2.63
4	8,923,534	2.26	10,197,961	2.59
5	8,863,609	2.15	10,466,925	2.54
10	8,494,878	1.65	11,772,466	2.29
15	7,977,713	1.25	12,887,673	2.01
20	7,252,362	0.91	13,559,690	1.70
25	6,235,020	0.63	13,390,486	1.35
30	4,808,145	0.39	11,767,735	0.95
35	2,806,879	0.18	7,765,241	0.50
40	0	0.00	0	0.00

* In thousands of dollars

Funding Advisory Committee Method

The funding method recommended by the Funding Advisory Committee in 1976 adopted level percentage of payroll amortization, but with a five-year phase-in to full actuarial funding by proposing that an increasing fractional portion of the amortization payment be contributed in the first four years, as follows:

Year	State, Teachers	Others
1	1/5	1/15
2	2/5	3/15
3	3/5	6/15
4	4/5	10/15

Because of the fractional contributions in the earlier years, the ultimate level percentage amortization contribution increases slightly. For all boards combined, the amortization contributions for the first four years and all years thereafter were:

Year	ERISA Standard	% of Payroll	Funding Advisory Committee
1	20.2%	10.9%	5.1%
2	20.2%	10.9%	7.1%
3	20.2%	10.9%	8.4%
4	20.2%	10.9%	10.0%
5 and after	20.2%	10.9%	12.0%

The progress toward funding the unfunded accrued liability using the Funding Advisory Committee approach would be generally similar to the level percentage of payroll schedule shown on Chart 1, except that the unfunded liability would increase more sharply during the first four years.

Modifications of Funding Advisory Committee Method

The recommendation of the Funding Advisory Committee selected a five-year phase-in period to full amortization payments, with the total amortization period remaining at 40 years. Some local boards have adopted or considered modifications of this approach, using longer phase-in periods and different phase-in curves. In addition to these two modifications, a longer or shorter amortization period may be selected.

Modification A

A simple modification of the Funding Advisory Committee approach, for those boards which are now into the phase-in period, is to recommence the five-year phase-in period. An illustration of projected funding costs using this approach is shown on Charts 2 and 3 for the State Employees' and Teachers' systems.

Modification B

The amortization period may be extended. For illustrative purposes, a 75-year amortization schedule, with the five-year phase-in as in Modification A, is shown on Charts 4 and 5 for the State Employees' and Teachers' systems.

Modification C

A longer phase-in period may be used. Charts 6 and 7 show the effect of this modification for the State Employees' and Teachers' systems by extending the phase-in period to ten years using fractions of 1/10, 2/10, 3/10, etc. for the first nine years.

These charts are patterned after the contribution projections exhibits in the January 1, 1979, actuarial valuations of the two systems used for the illustration.

The Pay-as-you-go Contribution represents the amount now required by statute to be appropriated each year; that is, the amount estimated to be paid to retired members and beneficiaries in that year exclusive of the annuity portion paid from the Annuity Reserve.

The Additional Contribution represents the excess, if any, of the total Funding Contribution over the required Pay-as-you-go Contribution.

Chart 2. Modification A

Projection for State Employees Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$1,016,592	$130,926	12.9	$147,406	14.5	$16,480
1981-82	1,062,339	145,670	13.7	174,224	16.4	28,554
1982-83	1,110,144	160,923	14.5	204,266	18.4	43,343
1983-84	1,160,101	176,476	15.2	235,501	20.3	59,025
1984-85	1,212,305	192,497	15.9	269,132	22.2	76,635
1985-86	1,266,859	211,341	16.7	281,243	22.2	69,902
1986-87	1,323,868	230,933	17.4	293,899	22.2	62,966
1987-88	1,383,442	251,008	18.1	307,124	22.2	56,116
1988-89	1,445,697	271,961	18.8	320,945	22.2	48,984
1989-90	1,510,753	296,647	19.6	335,387	22.2	38,740
1990-91	1,578,737	322,786	20.4	350,480	22.2	27,694
1991-92	1,649,780	349,870	21.2	366,251	22.2	16,381
1992-93	1,724,020	377,509	21.9	382,732	22.2	5,223
1993-94	1,801,601	411,984	22.9	399,955	22.2	0
1994-95	1,882,673	448,749	23.8	417,953	22.2	0
1995-96	1,967,393	484,761	24.6	436,761	22.2	0
1996-97	2,055,926	522,391	25.4	456,416	22.2	0
1997-98	2,148,443	565,740	26.3	476,954	22.2	0
1998-99	2,245,123	612,772	27.3	498,417	22.2	0
1999-00	2,346,153	663,307	28.3	520,846	22.2	0

Chart 3. Modification A

Projection for Teachers Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$ 996,506	$132,402	13.3	$120,577	12.1	$ 0
1981-82	1,041,349	143,707	13.8	148,913	14.3	5,206
1982-83	1,088,209	155,652	14.3	180,643	16.6	24,991
1983-84	1,137,179	168,161	14.8	213,790	18.8	45,629
1984-85	1,188,352	181,109	15.2	249,554	21.0	68,445
1985-86	1,241,828	196,578	15.8	260,784	21.0	64,206
1986-87	1,297,710	213,146	16.4	272,519	21.0	59,373
1987-88	1,356,107	230,829	17.0	284,782	21.0	53,953
1988-89	1,417,132	249,814	17.6	297,598	21.0	47,784
1989-90	1,480,902	272,697	18.4	310,989	21.0	38,292
1990-91	1,547,543	297,588	19.2	324,984	21.0	27,396
1991-92	1,617,183	324,546	20.1	339,608	21.0	15,062
1992-93	1,689,956	353,568	20.9	354,891	21.0	1,323
1993-94	1,766,004	387,821	22.0	370,861	21.0	0
1994-95	1,845,474	424,779	23.0	387,550	21.0	0
1995-96	1,928,520	464,731	24.1	404,989	21.0	0
1996-97	2,015,304	507,422	25.2	423,214	21.0	0
1997-98	2,105,992	556,878	26.4	442,258	21.0	0
1998-99	2,200,762	610,138	27.7	462,160	21.0	0
1999-00	2,299.796	667,397	29.0	482,957	21.0	0

Chart 4. Modification B

Projection for State Employees Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$1,016,592	$130,926	12.9	$142,323	14.0	$11,397
1981-82	1,062,339	145,670	13.7	163,600	15.4	17,930
1982-83	1,110,144	160,923	14.5	185,394	16.7	24,471
1983-84	1,160,101	176,476	15.2	209,978	18.1	33,502
1984-85	1,212,305	192,497	15.9	236,399	19.5	43,902
1985-86	1,266,859	211,341	16.7	247,037	19.5	35,696
1986-87	1,323,868	230,933	17.4	258,154	19.5	27,221
1987-88	1,383,442	251,008	18.1	269,771	19.5	18,763
1988-89	1,445,697	271,961	18.8	281,911	19.5	9,950
1989-90	1,510,753	296,647	19.6	294,597	19.5	0
1990-91	1,578,737	322,786	20.4	307,854	19.5	0
1991-92	1,649,780	349,870	21.2	321,707	19.5	0
1992-93	1,724,020	377,509	21.9	336,184	19.5	0
1993-94	1,801,601	411,984	22.9	351,312	19.5	0
1994-95	1,882,673	448,749	23.8	367,121	19.5	0
1995-96	1,967,393	484,761	24.6	383,642	19.5	0
1996-97	2,055,926	522,391	25.4	400,905	19.5	0
1997-98	2,148,443	565,740	26.3	418,946	19.5	0
1998-99	2,245,123	612,772	27.3	437,799	19.5	0
1999-00	2,346,153	663,307	28.3	457,500	19.5	0

Chart 5. Modification B

Projection for Teachers Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$ 996,506	$132,402	13.3	$114,598	11.5	$ 0
1981-82	1,041,349	143,707	13.8	137,458	13.2	0
1982-83	1,088,209	155,652	14.3	159,967	14.7	4,315
1983-84	1,137,179	168,161	14.8	185,360	16.3	17,199
1984-85	1,188,352	181,109	15.2	212,715	17.9	31,606
1985-86	1,241,828	196,578	15.8	222,287	17.9	25,709
1986-87	1,297,710	213,146	16.4	232,290	17.9	19,144
1987-88	1,356,107	230,829	17.0	242,743	17.9	11,914
1988-89	1,417,132	249,814	17.6	253,667	17.9	3,853
1989-90	1,480,902	272,697	18.4	265,082	17.9	0
1990-91	1,547,543	297,588	19.2	277,010	17.9	0
1991-92	1,617,183	324,546	20.1	289,476	17.9	0
1992-93	1,689,956	353,568	20.9	302,502	17.9	0
1993-94	1,766,004	387,821	22.0	316,115	17.9	0
1994-95	1,845,474	424,779	23.0	330,340	17.9	0
1995-96	1,928,520	464,731	24.1	345,205	17.9	0
1996-97	2,015,304	507,422	25.2	360,739	17.9	0
1997-98	2,105,992	556,878	26.4	376,973	17.9	0
1998-99	2,200,762	610,138	27.7	393,936	17.9	0
1999-00	2,299,796	667,397	29.0	411,664	17.9	0

Chart 6. Modification C

Projection for State Employees Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$1,016,592	$130,926	12.9	$138,257	13.6	$ 7,331
1981-82	1,062,339	145,670	13.7	156,164	14.7	10,494
1982-83	1,110,144	160,923	14.5	174,293	15.7	13,370
1983-84	1,160,101	176,476	15.2	193,737	16.7	17,261
1984-85	1,212,305	192,497	15.9	215,790	17.8	23,293
1985-86	1,266,859	211,341	16.7	238,169	18.8	26,828
1986-87	1,323,868	230,933	17.4	262,126	19.8	31,193
1987-88	1,383,442	251,008	18.1	287,756	20.8	36,748
1988-89	1,445,697	271,961	18.8	316,608	21.9	44,647
1989-90	1,510,753	296,647	19.6	345,962	22.9	49,315
1990-91	1,578,737	322,786	20.4	361,531	22.9	38,745
1991-92	1,649,780	349,870	21.2	377,800	22.9	27,930
1992-93	1,724,020	377,509	21.9	394,801	22.9	17,292
1993-94	1,801,601	411,984	22.9	412,567	22.9	583
1994-95	1,882,673	448,749	23.8	431,132	22.9	0
1995-96	1,967,393	484,761	24.6	450,533	22.9	0
1996-97	2,055,926	522,391	25.4	470,807	22.9	0
1997-98	2,148,443	565,740	26.3	491,993	22.9	0
1998-99	2,245,123	612,772	27.3	514,133	22.9	0
1999-00	2,346,153	663,307	28.3	537,269	22.9	0

Chart 7. Modification C

Projection for Teachers Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$ 996,506	$132,402	13.3	$110,612	11.1	$ 0
1981-82	1,041,349	143,707	13.8	128,086	12.3	0
1982-83	1,088,209	155,652	14.3	146,908	13.5	0
1983-84	1,137,179	168,161	14.8	167,165	14.7	0
1984-85	1,188,352	181,109	15.2	188,948	15.9	7,839
1985-86	1,241,828	196,578	15.8	212,353	17.1	15,775
1986-87	1,297,710	213,146	16.4	237,481	18.3	24,335
1987-88	1,356,107	230,829	17.0	264,441	19.5	33,612
1988-89	1,417,132	249,814	17.6	293,346	20.7	43,532
1989-90	1,480,902	272,697	18.4	324,318	21.9	51,621
1990-91	1,547,543	297,588	19.2	338,912	21.9	41,324
1991-92	1,617,183	324,546	20.1	354,163	21.9	29,617
1992-93	1,689,956	353,568	20.9	370,100	21.9	16,532
1993-94	1,766,004	387,821	22.0	386,755	21.9	0
1994-95	1,845,474	424,779	23.0	404,159	21.9	0
1995-96	1,928,520	464,731	24.1	422,346	21.9	0
1996-97	2,015,304	507,422	25.2	441,352	21.9	0
1997-98	2,105,992	556,878	26.4	461,212	21.9	0
1998-99	2,200,762	610,138	27.7	481,967	21.9	0
1999-00	2,299,796	667,397	29.0	503,655	21.9	0

Funding In Perpetuity

If one were to take the position that the unfunded accrued liability need never be amortized, but can continue to be carried as a perpetual debt, the only funding contribution required would be the normal cost plus an amount sufficient to keep the unfunded accrued liability from increasing. Since this liability is a discounted amount using 7% interest, a contribution of 7% of the unfunded accrued liability (in addition to normal cost) would be sufficient to keep the liability from increasing in actual dollars. This payment schedule would, however, exceed 40-year amortization as a level percentage of payroll for a number of years. Chart 1 on page 15 showed that the unfunded accrued liability actually increased for the first 22 years, indicating that the amortization payment was not sufficient to cover interest accruing on the unfunded portion during that period.

Charts 8 and 9 show projected contributions for the State Employees' and Teachers' systems if funded in such a manner that the dollar amount of the unfunded liability never were to increase.

Under this pattern of funding, however, the unfunded liability continues to decrease in real dollars assuming continued inflation. This can be demonstrated by calculating the ratio of the unfunded liability to the projected payroll, which is assumed to increase at the inflation rate of 4½%, as follows:

Fiscal Year	Ratio of Unfunded Liability to Payroll	
	State Employees	Teachers
1980-81	2.02	2.35
1989-90	1.36	1.58
1999-00	0.88	1.02

To carry this approach one step further, an amortization schedule may be constructed which will maintain the unfunded liability as a constant multiple of payroll, which would mean that the unfunded liability would remain constant to today's amount in terms of real, inflated dollars. This assumes that the systems are content to continue to carry an unfunded liability of today's magnitude indefinitely into the future.

Charts 10 and 11 show projected contributions for the State Employees' and Teachers' systems using this approach. On these charts, the Additional Contribution column is shown as negative when the Pay-as-you-go Contribution exceeds the Funding Contribution to indicate how this funding pattern would be insufficient to cover the required retirement payments during the 20-year projection period. If the Additional Contributions were invested at 7% interest, the State Employees' fund would be depleted in the 1994-95 fiscal year and the Teachers' fund in the 1991-92 fiscal year.

The current unfunded accrued liability under the systems has simply grown to too great a magnitude to be supported by this weak a funding program.

Chart 8. Funding in Perpetuity-Level Dollar

Projection for State Employees Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$1,016,592	$130,926	12.9	$271,911	26.7	$140,985
1981-82	1,062,339	145,670	13.7	277,675	26.1	132,005
1982-83	1,110,144	160,923	14.5	283,698	25.6	122,775
1983-84	1,160,101	176,476	15.2	289,993	25.0	113,517
1984-85	1,212,305	192,497	15.9	296,570	24.5	104,073
1985-86	1,266,859	211,341	16.7	303,444	24.0	92,103
1986-87	1,323,868	230,933	17.4	310,627	23.5	79,694
1987-88	1,383,442	251,008	18.1	318,134	23.0	67,126
1988-89	1,445,697	271,961	18.8	325,978	22.5	54,017
1989-90	1,510,753	296,647	19.6	334,175	22.1	37,528
1990-91	1,578,737	322,786	20.4	342,741	21.7	19,955
1991-92	1,649,780	349,870	21.2	351,692	21.3	1,822
1992-93	1,724,020	377,509	21.9	361,046	20.9	0
1993-94	1,801,601	411,984	22.9	370,822	20.6	0
1994-95	1,882,673	448,749	23.8	381,037	20.2	0
1995-96	1,967,393	484,761	24.6	391,712	19.9	0
1996-97	2,055,926	522,391	25.4	402,867	19.6	0
1997-98	2,148,443	565,740	26.3	414,524	19.3	0
1998-99	2,245,123	612,772	27.3	426,705	19.0	0
1999-00	2,346,153	663,307	28.3	439,435	18.7	0

Chart 9. Funding in Perpetuity-Level Dollar

Projection for Teachers Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$ 996,506	$132,402	13.3	$262,348	26.3	$129,946
1981-82	1,041,349	143,707	13.8	266,788	25.6	123,081
1982-83	1,088,209	155,652	14.3	271,427	24.9	115,775
1983-84	1,137,179	168,161	14.8	276,275	24.3	103,114
1984-85	1,188,352	181,109	15.2	281,341	23.7	100,232
1985-86	1,241,828	196,578	15.8	286,635	23.1	90,057
1986-87	1,297,710	213,146	16.4	292,167	22.5	79,021
1987-88	1,356,107	230,829	17.0	297,949	22.0	67,120
1988-89	1,417,132	249,814	17.6	303,990	21.5	54,176
1989-90	1,480,902	272,697	18.4	310,303	21.0	37,606
1990-91	1,547,543	297,588	19.2	316,901	20.5	19,313
1991-92	1,617,183	324,546	20.1	323,795	20.0	0
1992-93	1,689,956	353,568	20.9	331,000	19.6	0
1993-94	1,766,004	387,821	22.0	338,528	19.2	0
1994-95	1,845,474	424,779	23.0	346,396	18.8	0
1995-96	1,928,520	464,731	24.1	354,618	18.4	0
1996-97	2,015,304	507,422	25.2	363,209	18.0	0
1997-98	2,105,992	556,878	26.4	372,187	17.7	0
1998-99	2,200,762	610,138	27.7	381,569	17.3	0
1999-00	2,299,796	667,397	29.0	391,374	17.0	0

Chart 10. Funding in Perpetuity-Level % of Payroll

Projection for State Employees Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$1,016,592	$130,926	12.9	$180,512	17.8	$49,586
1981-82	1,062,339	145,670	13.7	188,635	17.8	42,965
1982-83	1,110,144	160,923	14.5	197,124	17.8	36,201
1983-84	1,160,101	176,476	15.2	205,994	17.8	29,518
1984-85	1,212,305	192,497	15.9	215,264	17.8	22,767
1985-86	1,266,859	211,341	16.7	224,951	17.8	13,610
1986-87	1,323,868	230,933	17.4	235,074	17.8	4,141
1987-88	1,383,442	251,008	18.1	245,652	17.8	(5,356)
1988-89	1,445,697	271,961	18.8	256,706	17.8	(15,255)
1989-90	1,510,753	296,647	19.6	268,258	17.8	(28,389)
1990-91	1,578,737	322,786	20.4	280,330	17.8	(42,456)
1991-92	1,649,780	349,870	21.2	292,945	17.8	(56,925)
1992-93	1,724,020	377,509	21.9	306,127	17.8	(71,382)
1993-94	1,801,601	411,984	22.9	319,903	17.8	(92,081)
1994-95	1,882,673	448,749	23.8	334,299	17.8	(114,450)
1995-96	1,967,393	484,761	24.6	349,342	17.8	(135,439)
1996-97	2,055,926	522,391	25.4	365,062	17.8	(157,329)
1997-98	2,148,443	565,740	26.3	381,490	17.8	(184,250)
1998-99	2,245,123	612,772	27.3	398,657	17.8	(214,115)
1999-00	2,346,153	663,307	28.3	416,597	17.8	(246,710)

Chart 11. Funding in Perpetuity-Level % of Payroll

Projection for Teachers Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$ 996,506	$132,402	13.3	$158,320	15.9	$25,918
1981-82	1,041,349	143,707	13.8	165,444	15.9	21,737
1982-83	1,088,209	155,652	14.3	172,889	15.9	17,237
1983-84	1,137,179	168,161	14.8	180,669	15.9	12,508
1984-85	1,188,352	181,109	15.2	188,799	15.9	7,690
1985-86	1,241,828	196,578	15.8	197,295	15.9	717
1986-87	1,297,710	213,146	16.4	206,174	15.9	(6,972)
1987-88	1,356,107	230,829	17.0	215,451	15.9	(15,378)
1988-89	1,417,132	249,814	17.6	225,147	15.9	(24,667)
1989-90	1,480,902	272,697	18.4	235,278	15.9	(37,419)
1990-91	1,547,543	297,588	19.2	245,866	15.9	(51,722)
1991-92	1,617,183	324,546	20.1	256,930	15.9	(67,616)
1992-93	1,689,956	353,568	20.9	268,492	15.9	(85,076)
1993-94	1,766,004	387,821	22.0	280,574	15.9	(107,247)
1994-95	1,845,474	424,779	23.0	293,200	15.9	(131,579)
1995-96	1,928,520	464,731	24.1	306,394	15.9	(158,337)
1996-97	2,015,304	507,422	25.2	320,181	15.9	(187,241)
1997-98	2,105,992	556,878	26.4	334,590	15.9	(222,288)
1998-99	2,200,762	610,138	27.7	349,646	15.9	(260,492)
1999-00	2,299,796	667,397	29.0	365,380	15.9	(302,017)

PRNCHLAR

In 1978, Mr. Edward H. Friend presented a paper at the annual meeting of the Conference of Actuaries in Public Practice which proposed a minimum funding standard for public pension plans called by the acronym "PRNCHLAR," which stands for "pension reform normal cost (and) half-life amortization (of the) ratio". The paper recognized that the majority of public pension plans were either not funding or seriously underfunding for the benefits promised, and proposed PRNCHLAR as a standard which should be attainable by any public system and which would make progress in amortizing the system's unfunded actuarial liability, not in dollar terms, but as a ratio to covered payroll.

PRNCHLAR embodies several restraints on the extent to which one year's cost is greater or lesser than the prior year's cost, on the treatment of actuarial gains and losses, and on the level of benefits to be promised to new employees. However, the basic funding objective is to halve the ratio of the unfunded actuarial liability to the covered payroll each 35 years. Amortization is calculated as a level percentage of covered payroll.

Without attempting to follow the year-to-year rules for adjusting the annual amortization payments which are an integral and essential part of the PRNCHLAR method, Charts 12 and 13 merely project costs for twenty years on a level percentage of payroll amortization calculated to reduce

the ratio of the unfunded actuarial liability to payroll by 50% over the first 35 years. As in Charts 10 and 11, the Additional Contribution column is displayed as a negative amount when the Pay-as-you-go Contribution exceeds the Funding Contribution to indicate the likelihood of the fund being fully depleted within the 20-year period. In this case, if the Additional Contributions were invested at 7% interest, the Teachers' fund would be depleted in the 1997-98 fiscal year, while the State Employees' fund would still be solvent at the end of the 1999-00 fiscal year, but become depleted shortly thereafter.

As with the perpetual funding approach using level percentage of payroll, the magnitude of the current unfunded accrued liability, and the projected payments arising from that liability, may be too large to allow the PRNCHLAR approach to be used without some modification that builds a somewhat larger pension fund in the early years of the program.

Chart 12. PRNCHLAR

Projection for State Employees Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$1,016,592	$130,926	12.9	$201,285	19.8	$70,359
1981-82	1,062,339	145,670	13.7	210,343	19.8	64,673
1982-83	1,110,144	160,923	14.5	219,809	19.8	58,886
1983-84	1,160,101	176,476	15.2	229,700	19.8	53,224
1984-85	1,212,305	192,497	15.9	240,036	19.8	47,539
1985-86	1,266,859	211,341	16.7	250,838	19.8	39,497
1986-87	1,323,868	230,933	17.4	262,126	19.8	31,193
1987-88	1,383,442	251,008	18.1	273,921	19.8	22,913
1988-89	1,445,697	271,961	18.8	286,248	19.8	14,287
1989-90	1,510,753	296,647	19.6	299,129	19.8	2,482
1990-91	1,578,737	322,786	20.4	312,590	19.8	(10,196)
1991-92	1,649,780	349,870	21.2	326,656	19.8	(23,214)
1992-93	1,724,020	377,509	21.9	341,356	19.8	(36,153)
1993-94	1,801,601	411,984	22.9	356,717	19.8	(55,267)
1994-95	1,882,673	448,749	23.8	372,769	19.8	(75,980)
1995-96	1,967,393	484,761	24.6	389,544	19.8	(95,217)
1996-97	2,055,926	522,391	25.4	407,073	19.8	(115,318)
1997-98	2,148,443	565,740	26.3	425,392	19.8	(140,348)
1998-99	2,245,123	612,772	27.3	444,534	19.8	(168,238)
1999-00	2,346,153	663,307	28.3	464,538	19.8	(198,769)

Chart 13. PRNCHLAR

Projection for Teachers Board
(Dollar amounts in thousands)

Fiscal Year	Projected Payroll	Pay-as-you-go Contribution	% of Payroll	Funding Contribution	% of Payroll	Additional Contribution
1980-81	$ 996,506	$132,402	13.3	$181,364	18.2	$48,962
1981-82	1,041,349	143,707	13.8	189,526	18.2	45,819
1982-83	1,088,209	155,652	14.3	198,054	18.2	42,402
1983-84	1,137,179	168,161	14.8	206,967	18.2	38,806
1984-85	1,188,352	181,109	15.2	216,280	18.2	35,171
1985-86	1,241,828	196,578	15.8	226,013	18.2	29,435
1986-87	1,297,710	213,146	16.4	236,183	18.2	23,037
1987-88	1,356,107	230,829	17.0	246,811	18.2	15,982
1988-89	1,417,132	249,814	17.6	257,918	18.2	8,104
1989-90	1,480,902	272,697	18.4	269,524	18.2	(3,173)
1990-91	1,547,543	297,588	19.2	281,653	18.2	(15,935)
1991-92	1,617,183	324,546	20.1	294,327	18.2	(30,219)
1992-93	1,689,956	353,568	20.9	307,572	18.2	(45,996)
1993-94	1,766,004	387,821	22.0	321,413	18.2	(66,408)
1994-95	1,845,474	424,779	23.0	335,876	18.2	(88,903)
1995-96	1,928,520	464,731	24.1	350,991	18.2	(113,740)
1996-97	2,015,304	507,422	25.2	366,785	18.2	(140,637)
1997-98	2,105,992	556,878	26.4	383,291	18.2	(173,587)
1998-99	2,200,762	610,138	27.7	400,539	18.2	(209,599)
1999-00	2,299,796	667,397	29.0	418,563	18.2	(248,834)

SECTION 4. CONCLUSIONS

This report has analyzed several different funding approaches for the public employee retirement systems in Massachusetts. Due to the lack of any significant advance funding in the past, the unfunded accrued liabilities of the systems have grown very large, thereby eliminating from serious consideration some of the weaker funding approaches which were shown to develop negative fund balances during the first 20 years.

The large body of actuarial opinion would encourage public pension systems to fund on the ERISA standard if possible, or at least on the alternate to the ERISA standard which determines the amortization contribution as a level percentage of covered payroll. It is understandable that, given the serious budget constraints of governmental entities today, some sort of phase-in program might be logical and justifiable. Alternate phase-in scedules were illustrated using the State Employees' and Teachers' systems as examples. It should be noted, however, that some of these approaches may be feasible for the State Employees' and Teachers' systems, but might fall short of meeting current cash requirements for other boards which currently have a larger ratio of unfunded actuarial liability to payroll than do the two major state systems. For example, the January 1, 1979, actuarial valuations showed the following ratios of unfunded actuarial liability to current payroll:

State Employees	2.21
Teachers	2.56
City of Boston	3.97
Other Local Boards	3.00
All Boards Combined	2.76

At present, Massachusetts statutes do not require any degree of advance funding for public retirement systems. Chapter 559 of the Acts of 1977 permits such advance funding at the option of cities, towns and districts. Several cities or towns have started such a program. Alternative funding schedules developed in this report, or modifications of those schedules using similar techniques, might be appropriate for those boards which have not adopted a funding program with a definite objective. A careful analysis of the funding program compared to the cash flow requirements for each board considering a particular funding schedule is advisable.

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